

## **Low cost Characterisation of Sun and Nadir Sensors for Attitude Control of Nano Satellites**

Nanosatellites based experiments are having an exponential growth in recent times. These satellites use miniaturised components that consumes less power. Attitude control of Nanosatellites depends upon various sensors such as sun sensor, nadir sensor, inertial measurement unit and others. All these sensors need to be qualified/characterised before the actual flight. Academic institutions and small companies don't have access to equipment that are dedicated for precise testing of these sensors.

This paper discusses about two different low cost testing methodologies of sun and nadir sensors in the laboratory requirement. These sensors are based CMOS camera technology that takes the image of the sun and earth to estimate the satellite attitude. First method uses direct sun as the light source with readings obtained for different azimuth and elevation. Second method uses xenon-arc lamp in a laminar flow chamber that closely resembles the sun spectrum. Third method uses multi-spectrum light source for the testing.

A separate setup was made for the nadir sensor testing in which an aerobics ball with light source from behind placed inside a dark chamber was used to simulate earth. Camera images of the aerobic ball (earth simulator) were taken from the sensor for different positions and attitude was estimated.

The experimental setup, comparisons, pros and cons for each of the methods are discussed in detail.